PROPHYLAXIS OF YELLOW FEVER.

Received through the Department of State from George E. Anderson, American Consul-General at Rio de Janeiro, Brazil.

The first authoritative and complete statement of the practical means by which, in accordance with modern theories of the spread of yellow fever, the number of deaths from that disease in Rio de Janeiro has been reduced from 4,852 in 1894 to none in 1908 and thereafter was made by Dr. Oswaldo Cruz, the head of the Public Health Service of Brazil, in a paper read before the Latin-American Medical and Sanitary Congress held in Rio de Janeiro August 1 to 10. Doctor Cruz's statement outlines in so practical and complete a way the methods followed that his paper is translated and submitted herewith. Doctor Cruz said:

We will not deal in this report with the scientific questions which served as the basis of the prophylactic campaign carried out against yellow fever in Rio de Janeiro from the point of view of the transmission of the disease by the mosquito. This is a subject well known to-day. We will record at the beginning the names of those who were pioneers in and the formulators of the wonderful theory which has brought such great benefits to humanity. It was Nott who, in 1848, first vaguely hinted at the fact that yellow fever and marsh fever might be transmitted by mosquitoes. But the real propagator of the modern ideas was the French physician Louis Daniel Beauperthuy, who defended them and based them upon a rich store of experiences, and who, on May 23, 1854, in an article published in No. 57 of the fourth volume of "The Official Gazette of Cumaná" (Venezuela)—an article now of an importance recognized by Doctor Agramonte—expounded with such clearness and exactness the theory of transmission of the yellow-fever germ by mosquitoes that to the reader it would seem that the writer had written after the memorable experiments made by the American commission in Cuba. Finlay defended the same theory and indicated the striped mosquito as the offender, basing his assertions on his very careful observations, though he failed in the experiments which he attempted to make with them as a basis, which failure subsisted until 1900–1901 when the American commission, under the direction of the ardent Doctor Reed, refuted the assertions of Sanarelli and brought forth its irrefutable experimental demonstration, later corroborated in Sao Paulo by Lutz and Ribas and in Rio at the Pasteur Institute by Marchoux and Simoned.

In this country, before the American experiments, Doctor Utingguassú and afterwards Doctor Stapler, of Sao Paulo, also made references to the transmission of yellow fever by the mosquito.

We will review here only the technique used, with the improvements made during the five years that the campaign was, without cessation, carried out, though not until recently crowned with perfect success. It is now more than a year since there has been a case of mortality from yellow fever in Rio de Janeiro. We have, therefore, reason to believe that Rio de Janeiro is freed from the onus given to it as the great yellow-fever center. The initiation of the prophylactic service was beset with some difficulties. It was proposed to undertake a new prophylaxis in a city of more than 800,000 people, extended over an area of 1,116 square kilometers (430 square miles), very irregular topography, the altitude varying from 1 to 460 meters above sea level; with 82,396 houses, in many of which lived people who did not always facilitate the efforts of the sanitary authorities.

The campaign against yellow fever was begun on April 20, 1903, under the direction of the Public Health Service and was called the Service for Prophylaxis of Yellow Fever. The direction of this service was given to the energetic Carneiro de Mendonça, who died just when the struggle was the most severe. The existing organization was of temporary character; it was important that stability be given it and that it have efficient support in actual expression of law. This was done under the government of

Rodrigues Alves, which secured the passage in Congress of the law of January, 1904, and which in reorganizing the hygienic service of the Union created the service for the prophylaxis of yellow fever. For the expense of prophylaxis in the whole country, including the ports, Rs. 5,500,000$000 ($1,650,000) was appropriated annually.

In order to carry out the prophylaxis programme the following personnel was designated, which was aided by the corps of inspectors of the Public Health Service for the Union: One medical inspector, 10 sanitary inspectors (physicians), 1 administrator, 1 customs inspector, 1 accountant, 70 medical students, 9 subchiefs, 200 overseers, 18 guards of the first class, 18 guards of the second class, 1,000 workmen.

The city was divided into zones, according to density of population, and in these zones the work of the prophylaxis corps was performed by two groups of the service: First, the division of isolation and sanitation; second, the policing of infected districts. To the first division was allotted the work of removing cases to the pesthouse, or isolating the residents, and disinfecting the houses for the exclusion of mosquitoes. The second division, the sanitary police force, was required to visit every building in the city, dwellings or other public or private buildings, and to destroy any mosquitoes found in the larva stage, and to take precautions to prevent mosquitoes having access to standing water in which they might breed. This division was separated into two sections, one to work in buildings, the other in vacant lots, streams, marshy lands, etc. Coordinate with the service thus undertaken, the department of public health carried out a defensive campaign, exercising the greatest medical vigilance over those resident in the infected districts. Let us note briefly what technique was followed and what difficulties were encountered which experience taught us how to overcome.

Yellow-fever cases were made known to the sanitary inspectors by the reports of medical assistants, of the head of the family in which a case occurred, or by any one to whom the facts of the case were known, in accordance with the requirements of the law. The sanitary service being advised, a competent group of inspectors and authorities were at once dispatched to the locality, having with them a physician. The latter ascertained if the case was one for isolation treatment (whether under or over four days after the onset of the disease), and if the case required isolation the same was carried out either in the dwelling house or in the hospital, hospital treatment being resorted to only when the dwelling was unsuited to isolation treatment or when the patient wished it. In such cases the patient was taken to hospital in a vehicle closed against the entrance of mosquitoes and the house was disinfected in accordance with the system below outlined. In the case of isolation in the home the physician chose a roomy quarter of the house with door opening into another secluded part of the house and with windows. If there were more than one door, the others were temporarily closed. The patient was kept under a netting enveloping the bed upon which he lay during the time permanent quarters were being arranged. The doors and windows of the room to be isolated and of the rest of the house as well were sealed to prevent the exit of mosquitoes existing there, the windows of the isolated room being fitted with wire screens in such a way as not to interfere with ventilation, all other openings to the outside or to other parts of the house being sealed with cloth or paper. The only door to be used in the use of the room must be specially fitted with a double door drum, provided with an arrangement which does not permit of both doors being opened at the same time. This apparatus prevents the entrance and exit of mosquitoes, and after the room is thus prepared the door and windows are closed and camomile is burned in the room 3 to 4 hours in the proportion of 10 grams per cubic meter of space. The room is then well ventilated and is ready to receive the patient. The rest of the house is well calked and isolated from the room in which the patient is placed and disinfected with sulphur gas, as below indicated. During this operation a sanitary inspector remains in the room with the patient and stops the entrance of any gas which may possibly find its way through some overlooked crevice. During the preparation for disinfection the sanitary authorities make a thorough inspection and destroy any mosquito larva they find, pick up or destroy any vessels lying about which might serve as a receptacle for mosquito-breeding water and close water boxes against the same danger. The patient remains in isolation for seven days, after which isolation may terminate, if the family so wishes. The infected district is then treated as above indicated; that is, by disinfection, sanitary policing, and medical supervision. Disinfection is carried on in two ways, one force working from the center toward the outer limits of the district and the other from the boundaries of the district inward. The area of infection being determined over as large an area as possible, these two sections separate, one of which begins immediately with the house in which the case of yellow fever occurred, the other beginning at those houses which might possibly have been infected at the greatest possible distance from the case in isolation. The purpose of such a system was to destroy all mosquitoes which might have carried infection within the district.

While the disinfecting force is thus at work the police division, under the direction of a physician and of students who direct the different sections, operates throughout the infected district, making every effort to destroy all mosquito larvæ and to prevent the possible breeding of mosquitoes outside as well as inside the houses. Where larvæ are likely to exist in stagnant water or refuse of any sort, petroleum mixed with creoline, lysol, or similar products is thrown over the water or refuse in sufficient quantity to kill the larvæ instantly. Where it is impossible to use petroleum, as in the case of tanks and boxes for household use, a small fish, the "barrigudo" or "Girardinus caudimaculatus" is placed in large numbers in the water. This fish destroys the larvæ of mosquitoes most voraciously. Larvæ in the drains are destroyed by the use of Clayton gas, which is pumped into the sewer, which has been previously divided into compartments. Simultaneously with the disinfection the sanitary inspectors make daily inspection of the suspected district, examining every inhabitant supposed not to be immune, that is, children under 5 and all foreigners of less than 5 years' residence in Rio. These are subjected to the closest vigilance, being placed in isolation at the least tendency to rising temperature. Reports are made in writing, those to whom this duty falls being required to fill out daily a bulletin sent out by the medical inspector to the chief of each district. In this report must be given the record of any who work outside the district or who for any reason absent themselves therefrom, a record of their condition being also kept by the physician in the district in which they work or are temporarily resident. When any inhabitant absents himself from the district the record must show his address, where he will be subjected to vigilance on the part of the authorities there. If the person under vigilance evades the attention of the physician and withdraws without giving notice, the owner of the house in which he lived is fined, he himself is apprehended by the sanitary police, fined, and subjected to renewed vigilance.

The vigilance in each district extends over a period of one month after the appearance of the last case. To give an idea of this service we will note the figures covering the prophylactic campaign in the infected district about the cotton factory, "Fabrica das Chitas," in 1906. The inspection was carried out by 18 doctors, who examined daily all suspected persons, in all, 7,966 persons, of whom 2,989 were not immune. Sixty cases were reported, of which only 19 proved to be yellow fever, and the district was declared entirely freed of infection after six months. With the combination of the three systems there is no doubt about cleaning up effectively any district in which yellow fever may appear. In normal conditions the police service is carried out with equal painstaking, especially in the districts where infection last appeared. When, after some time, there seems no longer to be danger of new infection, the inspectors allow water to stand in several marked spots most favorable to mosquito breeding. These pools are then carefully watched, and examined at frequent intervals. This is a sure way to indicate the presence of the mosquito and is a trap for those about to spawn. They are thus most easily destroyed. In many zones of the city these traps revealed the presence of no mosquitoes whatever.

The disinfection of houses with sulphur gave the best results. The house to be disinfected was completely closed. Every opening or orifice where gas might escape was sealed with gummed paper. The furniture, too, after being thoroughly cleansed, is tightly closed. Metallic or gilded objects are protected with a covering of vaseline. After the roof is covered over with canvas the garrets are opened for the free access of sulphur gas. The canvas is fastened to the walls with lath. Then sulphur is burned in the proportion of 10 to 20 grams per cubic meter, being deposited in several receptacles distributed about the house and kept clear of the floor. Each receptacle should not contain more than 1 kilogram (2.2 pounds) in order to insure complete combustion. In the vacant spaces under the roof the burning sulphur should be placed in receptacles set into others containing water, to avoid danger of fire. After all the receptacles are placed the workmen close up the only exit left open and keep the house thus sealed for not less than 2 hours. The heated air and that displaced by the sulphur gas escapes through the crevices of the roof, but the mosquitoes are kept in by the canvas covering.

The disinfecting gangs always carry on their work at a greater distance from the focus in the direction of the wind, since mosquitoes are most apt to carry infection with the prevailing winds.

Thus were carried out the details of the yellow fever campaign in this city. In the exposition annexed to the present congress, in the part occupied by the public health service may be seen the demonstrations of the above methods, the materials used, the various processes described, as well as the graphic description of the results obtained. Those who are interested in the beginning of the campaign from the point of view of the above discussion and in the influence of the various factors in the development of the sanitary service as affecting yellow fever should read the important memorials of Dr. Bulhões de Carvalho, in "Contributions to the Epidemiological State of Yellow Fever," Rio, 1903, and of Oliveira Borges, in "Prophylaxis

of Yellow Fever in Rio de Janeiro," presented to the Third Latin American Medical Congress in Montevideo, March 17 to 23, 1907.

In closing we present below the statistics showing the death rate from yellow fever from 1872 to date, which serve to prove the statement in the beginning of this communication that yellow fever is wiped out in Rio de Janeiro.

Mortality from yellow fever in Rio de Janeiro from 1872 to August, 1909.

Year.	Deaths.	Year.	Deaths.
1872	102	1891	4,456
1873	3,659	1892	4,312
1874	829	1893	825
1875	1,292	1894	4,852
1876	3,476	1895	818
1877	282	1896	2,929
1878	1,176	1897	159
1879	974	1899	1,078
1880	1,625	1899	731
1881	257	1900	344
1882	89	1901	2,299
1883	1,608	1902	984
1884	863	1903	584
1885	445	1904	48
1886	1,449	1905	289
1887	137	1906	42
1888	747	1907	39
1889	2,156	1908	4
1890	719	1909	0

UNITED STATES.

[Reports to the Surgeon-General, Public Health and Marine-Hospital Service.]

Plague-prevention work in California.

Surgeon Blue reports:

SAN FRANCISCO, CAL.

Last case of human plague: Sickened, January 30, 1908.
Last case of rodent plague: Trapped, October 23, 1908.

Week ended October 30.

Dead inspected	124
Plague	0
Premises inspected	1,906
Houses disinfected	6
Buildings condemned	6
Nuisances abated	219
Rats found dead	34
Rats trapped	2,029
Total rats taken	2,063
Rats identified:	
Mus norvegicus	1,546
Mus rattus	84
Mus musculus	370
Mus alexandrinus	29
Total	2,029
Rats identified as to sex:	
Male	750
Female	841
Total	1,591
Rats examined bacteriologically	1,331
Plague rats	0
Poisons placed	12,300
Total number of rats found infected to date	398